such as I make them roughly, do not convince me that the argument is without force. My chief criticism on the equation has two branches:—1. Mr. Bashforth has nowhere proved that he is entitled to use the k belonging to the mean velocity over the arc. 2. Granting that he may use that k, we have then to consider whether he has got v_B and k to accord. For my part, I do not feel the degree of certainty which Mr. Bashforth expresses about this, especially if the work is carried over a considerable arc. I will grant that his result comes near the truth, but assuredly he cannot be said to have determined v_B *accurately*, as he affirms.

I cannot help thinking that there is no real difference between Mr. Bashforth and myself, for all that I have said against the equation (a) can be said in another form against the method that I prefer, and I willingly indorse the statement in the last paragraph but one of his letter. I may be allowed to add that all methods hitherto proposed of calculating shot ranges seem to me too difficult for common use, and I believe what would really be a boon to the artilleryman is a book of trajectories drawn to scale. This might be accomplished very well by Mr. Bashforth's tables and methods in the hands of some one competent to use them, the simpler methods, as I think them, introduced by me, being also of some service. I trust this will be done when the resistance to shot moving with low velocities has been ascertained, as I hear it is to be, by a series of experiments under Mr. Bashforth's superintendence.

Allow me in conclusion to express my regret that I should seem to have been reviewing in a hostile spirit any part of the work done by Mr. Bashforth at Woolwich. I will only assure him that nothing could have been further from my thoughts than to do so.

W. D. NIVEN

Trinity College, Cambridge, March 30

The Daylight Meteor of March 25

A CORRESPONDENT in NATURE described the falling of a daylight meteor on Monday, March 25. I have received information respecting this meteor from five persons who witnessed its fall.

Mr. McIntyre, who saw it from near Dunston-on-Tyne; Mr. Wood, banker, who saw it whilst leaving his residence at Benton, near Newcastle-on-Tyne; Mrs. Hopper, from Gosforth, one mile north of Newcastle; Mrs. Lupton, who saw it from a railway carriage at Brampton, near Carlisle; and Mr. W. Clarke, of Newburn, who saw it at Wallbottle, four miles west of Newcastle. All these observers agree in the following particulars:—1. That the meteor was visible at 10.20. 2. That it was very luminous with a white light slightly coloured. 3. That it fell at a slight inclination from E. to N., and reached the horizon at or near the north point. 4. That the weather was clear and the sun shone brightly at the time the meteor was visible.

T. P. BARKAS

26, Archbold Terrace, Newcastle-on-Tyne

Meteor

ON the night of Tuesday, April 2, at about 7.55 o'clock, I was standing with two companions, facing the north, when we were surprised to observe the ground before us suddenly lighted up, and our three shadows sharply defined upon it. One of my friends exclaimed, "Why, there's the moon come out!" We turned round and beheld a wonderfully brilliant meteor descending almost perpendicularly from about 5° east of Betelgeux, in Orion, towards the most eastern of the three stars in the belt. Its course was slightly zig-zag, its colour yellow or orange, its apparent size about half the diameter of the full moon. It vanished noiselessly before reaching the belt, and left no visible remains. When we first saw it there appeared be a short trail of light behind it. About three minutes after its disappearance a rumbling sound was heard like distant thunder, from the same direction. Whether this was connected with the meteor I cannot tell. If so it would indicate a distance of about forty miles, and we ought to hear of this meteor from the neighbourhood of Warwick.

F. T. MOTT

Birstal Hill, Leicester

[The same meteor was seen by several *Times* correspondents. It made its appearance in Ursa Major, and after remaining stationary for a second or two between Orion's Belt and Sirius, fell at a comparatively slow rate and in a direct line to the horizon. It was pear-like in shape, seemed three or four times larger than Jupiter, and was intensely bright. Its colour changed from a silvery white to a pale red as it approached the horizon, where it disappeared behind a cloud, leaving a long track of light behind it.]

To Entomologists

AS I have undertaken the section "Arthropoda" for the "*Jahresbericht für Anatomie und Physiologie*, of Hoffmann and Schwalbe," and find some difficulty in obtaining English scientific journals (specially the entomological ones) here in Naples, will you permit me through your columns to request such of your readers as may have published papers on the *anatomy*, *ontogeny*, and *phylogeny*, of the *Hexapoda*, *Myriapoda*, *Arachnoidea*, *Protracheata*, *Poecilopoda*, and *Crustacea* in 1877, or intend to do so in 1878 and the following years, to be kind enough to forward me a copy of them, or at least to inform me of the fact?

PAUL MAYER

Naples, Stazione Zoologica, March 31

GEOGRAPHICAL NOTES

ROYAL GEOGRAPHICAL SOCIETY MEDALS.—The Founder's Medal for 1878, of the Royal Geographical Society, has been awarded to Baron F. von Richthofen for his extensive travels and scientific explorations in China; also for his great work now in course of publication, in which the materials accumulated during his long journeys are elaborated with remarkable lucidity and completeness. The Patron's Medal has been given to Capt. Henry Trotter, R.E., for his services to geography, in having conducted the survey operations of the late Mission to Eastern Turkistan, under Sir Douglas Forsyth, which resulted in the connection of the Trigonometrical Survey of India with the Russian Surveys from Siberia, and for having further greatly improved the map of Central Asia. Mr. Stanley, being already a medallist, is disqualified from receiving a similar honour, but he has been elected an honorary corresponding member, and is to receive the thanks of the Council for his discoveries.

AFRICA.—With a view to facilitating the progress of the London Missionary Society's contemplated expedition from the East Coast of Africa to Lake Tanganyika, the Rev. Roger Price, who had had long experience of roads and waggons in South Africa, was despatched to Zanzibar in 1876, to make investigations respecting a new route and new mode of travelling into the interior. He made the experiment of using bullocks and waggons in the place of *pagazi*, and with so much success that it was resolved that the expedition should adopt that mode of conveyance for themselves and their goods, and a flourishing account of the new scheme was given before the Royal Geographical Society on February 26, 1877. Before the expedition arrived at Zanzibar in the summer of last year, Mr. Mackay, an agent of the Church Missionary Society, was reported to have cleared a road nearly, if not quite, as far as Mpwapwa, and it was supposed that the expedition would reach the Lake with great ease. Their hopes, however, have been grievously disappointed. The road has turned out to be no road at all, and most of the oxen have died from the effects of the climate. Mr. Price returned to England some little time back, convinced, we believe, of the present impracticability of his bullock-waggon scheme, and sad to relate, it has been found necessary to revert to the old *pagazi* system, the curse of African travel. By latest accounts the expedition had formed a camp at Kirasa, in Usugara, on the edge of the high plateau, and about forty miles east of Mpwapwa, and there they intend to remain till after the rainy season.—Lieut. J. B. Wathier has been appointed to join the Belgian expedition at Zanzibar, which recently lost two of its members, MM. Crespel and Maes. He has visited Dr. Nachtigall at Berlin, to obtain the advice of the experienced explorer, and left Brindisi for Zanzibar on the 5th inst. Dr. Nachtigall himself, as leader of the German expedition, is to start from St. Paul de Loanda, and it is hoped that the two expeditions may meet in the centre of Africa.

On the 5th inst. Lieut. de Semellé left Bordeaux for the purpose of setting out on his proposed journey across Africa from Senegambia. The Society of Algerine Catholic Missions has obtained from the Pope an authorisation to send two parties of priests into the interior of Africa; one, under the direction of Father Pascal, will establish a *vicariat apostolique* on the banks of Lake Tanganyika; the second party, whose head is said to be Father Livinzac, will establish a similar organisation in the region of the Nyanzas. The missions will be scientific as well as religious.

Arctic Exploration.—A wealthy Russian merchant M. Sibiriakoff has offered the sum of 12,000 roubles to the Committee of the Dutch Arctic Expedition, on condition that the Committee should order that the Siberian coasts be specially explored by the Expedition. The Committee has, however, refused the offer, on the one hand because it was considered undignified to accept foreign help for a purely national undertaking, and on the other, because the expedition has a specifically scientific and not a commercial object. This offer of M. Sibiriakoff seems unnecessary, seeing that the Siberian coast is likely to be explored this summer by Prof. Nordenskjöld in the *Vega*. We may remind our readers that this expedition sets out in the beginning of July, for the purpose of forcing the North-East Passage from Europe to Behring's Straits. Prof. Nordenskjöld has made a thorough study of the records of Russian exploration along the north coast of Siberia, and concludes that in early autumn the ice retires from the coast as a rule, leaving a comparatively clear waterway. Even should the immediate aim of the expedition not be accomplished, we may expect large additions to our knowledge of the hydrography, geology, and natural history of these regions, which, from a scientific point of view, have been comparatively unexplored. Prof. Nordenskjöld conjectures that a line of islands separates the Siberian from the strictly Polar Sea, of which we only know Wrangell Land and New Siberia; he will endeavour to verify this conjecture. The proposal has been made in the first Chamber of the Swedish Reichstag to grant the sum of 22,000 Swedish crowns for the Arctic Expedition projected by Lieut. Sandeberg, the costs of whose exploration in Lapland, to which we have already referred, were defrayed entirely by himself.

Cairo Geographical Society.—At an extraordinary meeting of this society on February 16 the question of its existence was discussed; it had become almost extinct from want of funds. It was proposed to join it to the Egyptian Institute, thereby much diminishing its working expenses, and putting it in an advantageous position for carrying on its work. We hope the scheme will be carried out, as the situation of the society places it in an unusually favourable position for carrying on the work of African exploration.

South America.—Advices from Valparaiso state that Commander Paget, of Her Majesty's ship *Penguin*, communicated to the captain of the port of Coquimbo that while passing through Messier's Channel, on January 10, he saw a volcano in eruption, situated E. ¼ S. (Mag.) of the southern extremity of Middle Island, English Narrows. It is supposed that this volcano is the cause of the subterranean noises heard by an exploring party from the corvette *Magallanes*, near Lake Santa Cruz, in the middle of December, and is the same as that believed to exist by the Argentine explorer Moreno. *Apropos* of the foregoing, says the *Timpos*, one of the most remarkable discoveries made by Chilian explorers is the complete disappearance of the Andes chain at the southern extremity of the continent. Messrs. Rodgers and Ibar crossed from Brunswick Peninsula, situated, according to the Argentines, to the east of the Andes, to the Pacific, arriving at a place called by Fitzroy the plains of Diana, without meeting with vestiges of the Cordillera. There are plains, more or less inclined, but only plains.

Ethnography of Russia.—As Supplement 54 to Petermann's *Mittheilungen*, Col. Rittich's valuable and elaborate treatise on the ethnography of Russia has just been published, with a large map, coloured with the greatest care, and showing with wonderful clearness the many elements which go to make up the Russian population.

The Yenissei.—To the April number of the *Geographical Magazine* Mr. Seebohm contributes a paper on the Valley of the Yenissei, embodying some of the results of his recent voyage to that river.

The Whang-ho.—In the same number is the first instalment of an exhaustive paper on this river, with special reference to its double delta, by Mr. Samuel Mossman.

Educational Voyage.—A voyage around the world, designed for students, is being arranged at Paris. It will last eleven months, over six months being devoted to various land excursions. Books, collections, &c., will be taken, and the entire programme will have instruction, rather than sight-seeing, in view. It is intended to depart on June 15.

Paris Geographical Society.—The January *Bulletin* of this Society contains the first part of an important inquiry into the medical geography of the West Coast of Africa, by Dr. H. Rey, and also the first instalment of a narrative of a journey in Cilicia in 1874 by MM. C. Favre and B. Mandrot. M. Nogueira gives a translation of a paper from the Portuguese on the South African river Cunene.

The Council of the Society of Geography has issued its list of candidates for the high offices of the society. It proposes to the members to elect Admiral La Roncière le Nourry, who has been voted six or seven times almost without opposition. But a number of independent members are proposing, in opposition, the nomination of the present Minister of Marine.

Depths of Lakes.—*The Bavarian Courier* publishes an interesting comparative statement of the depths of lakes. Amongst European lakes the Achensee, in the Tyrol, heads the list. At some points the depth of this lake amounts to 772 metres. The greatest depth of the lake of Constance is about 300 metres, that of the Chiemsee about 141 metres, and that of the Walchen- and Königssee, 188 metres. The measurements made about 1870 at the Dead Sea showed that at its deepest part the depth is 565 metres, but if we consider that the level of this lake is already 429 metres below the level of the Mediterranean, then we find that the total depression in the soil here amounts really to 994 metres. The Lake of Tiberias is extremely shallow in comparison; on its eastern part the average depth is only eight metres, while on the western side it lies between six and seven metres. In Lake Baikal depths have been found which for a lake are truly astonishing. In the upper part of the lake the depth is 3,027 metres (about the height of Mount Etna), but downwards the bottom constantly descends, and near the opposite bank the depth amounts to 3,766 metres. This depth far exceeds that of the Mediterranean Sea, which at its deepest part measures only 2,197 metres.

German Alpine Club.—The German and Austrian *Alpen Verein*, although comparatively young, has developed a most praiseworthy activity in a variety of directions. From the last general report we notice that it has a membership of nearly 7,000, and an annual income of 40,000 marks. The chief exertions are devoted to the erection of shelter huts in the Alps, and maintenance of communications over the passes. It is, however, rendering no slight service to the cause of geography, by the gradual preparation of elaborate maps of the German and Austrian Alps. At present it is engaged on a map of the Salzkammergut, on a scale of 1 : 100,000.

A LUNAR LANDSCAPE

MESSRS. GAMMON AND VAUGHAN, No. 28, Old Bond Street, have at present on view a picture in which the artist, Olafs Winkler, of Weimar, has endeavoured to represent a lunar landscape. Prof. C. Bruhns, of Leipzig, has assisted him in the parts of the treatment which are directly scientific.

The painter has not trusted all to his imagination. He has, to the best of his knowledge and ability, sought to stick rigidly to truth, and to paint a lunar landscape such as it would appear, so far as human observation has hitherto ascertained, to a human eye, were it at all possible for a man to be transplanted to the moon and observe through his earthly eyes, only for a moment, nature as she manifests herself on the surface of our satellite. From the merely artistic point of view the artist fears his task may be a thankless one, for since the moon has no atmosphere, there is neither aërial perspective nor diffusion of light, but it is precisely this point which should make our artist all the more interested in this unique production. The shadow of a body in the foreground will appear quite as black as the sky itself which closes the landscape like a flat steep wall, broken only by the quiet light of the stars. All lights appear equally strong at a distance and close at hand, and this also holds with the local colouring. In a word, there is wanting in the lunar landscape that which lends to our earth perspective, richness of tone, modulation, softness, and temper. It is our atmosphere we have to thank for most of the multitudinous coloured phenomena of the terrestrial landscape—phenomena which in our satellite are impossible. The sunlight falls upon the hills with blinding brightness, and cuts sharply across the deep black shadows. Its intensity rivals the electric light, and light effects of such a kind are far beyond the reach of our palettes. We must resort to some expedient to be able to introduce a medium between the extreme contrast of light and shade, a sort of half-tone, which, at the same time, must be the chief tone of the picture; this Herr Winkler has sought in the light of the earth, the true "earthshine."

The artist has chosen the time of sunset, and the region he has selected lies in the northern part of the moon. The spectator is supposed to be on the front slope of a mountain, the continuation of which in the background comes out as a closed ridge. At his feet one of the numerous *maria* spreads out, filled up with rills, circular hills, and large and small craters, stretching away to the distant mountain referred to. Before, us in the black sky, hangs the moon's moon, our earth. She sheds her pale, ash-coloured light over the rent, desolate, dead stone-fields. Only the highest points of the mountain-tops still glow in the light of the setting sun, no longer red, as here, but dazzlingly white, in consequence of the absence of atmospheric absorption. The earth is at the period of her course between Sagittarius and the Scorpion, Antares being nearly in the middle of the picture. Against his persuasion he has been compelled to make the milky way very weak, and the stars somewhat large in proportion to the earth.

Herr Winkler, in a paper read at the last meeting of the German Association, stated that his first impulse to undertake the picture was derived from Nasmyth and Carpenter's work on the moon.

Our only criticism of the picture refers to the colour of the earth and of the true earthshine. We doubt whether the earth is quite red enough, especially at the edges, and we doubt again whether, with the earth as ruddy as it is, the colour of the lunar landscape itself should not be rather more in harmony with it, as it is the true light source.

The picture is an admirable performance, and the science of it is so true that, as we hinted before, those of our artists who care to have a natural basis for their depiction of natural phenomena will learn much from this attempt to deal with a new order of phenomena.

EDISON'S TALKING-MACHINE[1]

MR. THOMAS A. EDISON has recently invented an instrument which is undoubtedly the acoustic marvel of the century. It is called the "Speaking Phonograph," or, adopting the Indian idiom, one may aptly call it "*The Sound-Writer who Talks.*" Much curiosity has been expressed as to the workings of this instrument, so I purpose giving an account of it.

All talking-machines may be reduced to two types. That of Prof. Faber, of Vienna, is the most perfect example of one type; that of Mr. Edison is the only example of the other.

Faber worked at the source of articulate sounds, and built up an artificial organ of speech, whose parts, as nearly as possible, perform the same functions as corresponding organs in our vocal apparatus. A vibrating ivory reed, of variable pitch, forms its vocal chords. There is an oval cavity, whose size and shape can be rapidly changed by depressing the keys on a key-board. A rubber tongue and lips make the consonants; a little windmill, turning in its throat, rolls the letter *r*, and a tube is attached to its nose when it speaks French. This is the anatomy of this really wonderful piece of mechanism.

Faber attacked the problem on its physiological side. Quite differently works Mr. Edison: he attacks the problem, not at the source of origin of the vibrations which make articulate speech, but, considering these vibrations as already made, it matters not how, he makes these vibrations impress themselves on a sheet of metallic foil, and then reproduces from these impressions the sonorous vibrations which made them.

Faber solved the problem by reproducing the mechanical *causes* of the vibrations making voice and speech; Edison solved it by obtaining the mechanical *effects* of these vibrations. Faber reproduced the movements of our vocal organs; Edison reproduced the motions which the drum-skin of the ear has when this organ is acted on by the vibrations *caused* by the movements of the vocal organs.

Figs. 1 and 2 will render intelligible the construction of Mr. Edison's machine. A cylinder, F, turns on an axle which passes through the two standards, A and B. On one end of this axle is the crank, D; on the other the fly-wheel, E. The portion of this axle to the right of the cylinder has a screw-thread cut on it, which, working in a nut, A, causes the cylinder to move laterally when the crank is turned. On the surface of the cylinder is scored the same thread as on its axle. At F (shown in one-half scale in Fig. 2) is a plate of iron, A, about $\frac{1}{100}$ of an inch thick. This plate can be moved toward and from the cylinder by pushing in or pulling out the lever H G, which turns in an horizontal plane around the pin I.

The under side of this thin iron plate, A (Fig. 2), presses against short pieces of rubber tubing, X and X, which lie between the plate and a spring attached to E. The end of this spring carries a rounded steel point, P, which enters slightly between the threads scored on the cylinder C. The distance of this point, P, from the cylinder is regulated by a set-screw, S, against which abuts the lever, H G. Over the iron plate, A, is a disc of vulcanite, B B,

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[1] The figures in this article are taken from "Sound, a Series of Simple, Entertaining, and Inexpensive Experiments in the Phenomena of Sound, for the Use of Students of every Age." By Alfred M. Mayer. Vol. ii. of "Experimental Science Series for Beginners." (Now in press and soon to be published by D. Appleton and Co.)